The salts of Ga which M. Lecoq de Boisbaudran has used in his researches, have been from the blend of Pierrefitte; he has, however, found the new metal in other ores of zinc, and notably in a transparent blend from Santander. He believes Ga will be met with in all blends. The Ga he extracted from the blends comes really from these minerals, and not from metallic zinc.

The author's last researches have confirmed the rarity of gallium in blend. The extreme sensibility of the spectral reaction led him even to over-estimate the quantities obtained. "I do not think I exaggerate," he remarks, "in saying that in my first observation I possessed at the most $\frac{1}{100}$ of a milligramme of the new substance dissolved in a very small drop of liquid. The spectral analysis of so small a quantity of matter would have been impracticable before the considerable reduction I made in the dimensions of the apparatus for obtaining electric spectra, and without using very small sparks.

"If, as I suppose, there is no error as to the nature of my alum of Ga, the existence of this salt fixes the atomicity of the new element, and attributes to its oxide the same chemical function as that of alumina. The oxide of gallium, then, will be written Ga_2O_3."

The author, in conclusion, refrains, for the present, from discussing the theoretical considerations raised in a recent note by M. Mendeleeff. Questions of the kind have long interested him; but he thinks it very probable that without the particular method followed in the present research, neither M. Mendeleeff's theories nor his own would soon have led to the discovery of gallium.

SCIENTIFIC SERIALS

American Journal of Science and Art, November.—The original articles in this number are:—On the variation in the strength of a muscle, by F. E. Nipher.—Studies on magnetic distribution, by H. A. Rowland. This, Part I., is on linear distribution, and the scope is indicated by the titles of the sections: 1. Preliminary Remarks; 2. Mathematical Theory; 3. Experimental Methods for Linear Distribution; 4. Iron Rods magnetised by induction; 5. Straight Electro-magnets and permanent Steel Magnets; 6. Miscellaneous Applications.—Œstivation and its terminology, by Asa Gray.—A note in relation to the mass of meteoric iron that fell in Dickson County, Tenn., 1835, by J. L. Smith.—Specific gravity balance, by Roswell Parish. The object of this is to determine the specific gravities of minerals, and other solids heavier than water, without the use of exact weights and without mathematical computation.—A paper on Southern New England, by Prof. Dana.—Iowa county meteor and its meteorites, by N. R. Leonard.—On the post-Pliocene fossils of Sankoty Head, Nantuck Island, by A. E. Verrill. This article, referring to the paper by Desor and Cabot (Geol. Soc. Lond., 1849), purports to correct some matters of detail in that paper, and raises the number of known species from seventeen to sixty, of which a list is given.—In the short articles under "Scientific Intelligence" are:—Arithmetical relations between the atomic weights; Evidence of glacial action on the summit of Mount Washington; Discovery of the horns of an extinct species of ox in Ohio.—The two following reports are noticed: On the geology and resources of the region in the vicinity of the 49th parallel from the Lake of the Woods to the Rocky Mountains; A reconnaissance of the Black Hills of Dakota made in the summer of 1874.—In an appendix Prof. O. C. Marsh contributes a paper on the Odontornithes, or birds with teeth. After recapitulating facts he has already contributed, he gives this classification:—Sub-class, ODONTORNITHES: A. Teeth in sockets; vertebræ biconcave; sternum with keel; wings well developed; order, *Ichthyornithes*. B. Teeth in grooves; vertebræ as in recent birds; sternum without keel; wings rudimentary; order, *Odontolcæ*. There are two plates in illustration of this paper.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Oct. 15.—In the concluding part of his article on the higher atmospheric strata, Dr. Hellmann gives the following results:—(2) Moisture: time of maximum, upper station, 4.30 P.M.; lower station, 5.43 P.M.; time of minimum: upper station, 7·3 A.M; lower station, 7.30 A.M. The daily variation at the upper station is only half that at the lower station. From a table of relative humidity we learn that the air is much moister at the upper station and removed by an almost constant quantity from saturation. In the morning and evening the lower air is the moister, at midday the upper. (3) Wind. Easterly winds were less prevalent at the summit than at the foot of Mount Washington, in the proportion of 1 : 2. It is now well ascertained that the wind at ordinary heights increases in strength daily from early morning till about 2 P.M., and then decreases until about 9 P.M. Herr Hellmann was surprised to discover a variation exactly contrary to this to hold on the summit. In fact, the least velocity occurs about 1 P.M., the greatest after 12 at night; while at the foot the usual variations were followed. Dove explains the generally observed increasing velocity in the morning in our climate by the combined action of a large mass of heated air ascending in the east, and the prevalence of westerly winds. In the evening the heated area would lie westward, the two influences would oppose each other and the wind would decrease in velocity. Similarly the diminution of velocity from early morning to mid-day at great heights may be caused by the overflow westward of the air heated in an area east of the station opposing the prevailing west wind, and the acceleration in the afternoon by the overflow eastward from the heated area now in the west adding itself to the west wind. In agreement with this view is the fact, shown by observations on the Rigi, that velocity in summer is least about mid-day, much greater in the early morning and late evening, and in winter on the contrary, in harmony with the variations at low levels. The greatest observed velocity was ninety-six miles an hour. While this storm blew aloft a calm reigned below. But is it not likely that a current was drawn upwards by it? We have no instruments to register vertical currents. With respect to the relation of temperature to height, clearly it cannot be simply formulated, and will differ according to the altitude at which the daily ascending current flows off laterally. (4) Clouds. There was more cloud and fog at the summit about midday than at other times, and, roughly speaking, the amount of cloud varied inversely as that below during the daytime.

Memorie della Societa degli Spettroscopisti Italiani, March, contains a table by Father Secchi, showing the number of protuberances and spots viewed, and the number of days on which observations were made during each revolution of the sun from April 1871 to March 1875, in all forty-two revolutions. The number of protuberances or spots seen during each revolution, divided by the number of days, gives an average for each day; this in 1871 was about 26 for protuberances and 100 for spots, and decreases gradually down to 5·45 for protuberances and 18·8 for spots, in March last. Drawings of the chromosphere for January, February, and March, by Secchi and Tacchini, also accompany this number.

May.—A paper by Prof. Bredichin, on spectroscopic observations of the sun, referring to the relation between spots and prominences, or the latter being the cause of the former. A long series of observations by Prof. Tacchini, from February to June 1873, showing the positions on the sun in which prominences containing magnesium or giving the 1474 line were seen. The maximum number of positions in which magnesium was observed for any one day was sixty, and the same number for the 1874 line.—Prof. Pisati contributes a paper on the theories of electro-static induction.

June.—Prof. Tacchini writes on a method of determining the angles of position of spots and faculæ. In this case the image of the sun is thrown by the eye-piece of the telescope on to a screen on which is a divided circle, with which the image of the sun coincides.—Father Secchi contributes a paper on the solar prominences observed from April 1871 to June 1875. Accompanying this paper are tables showing the number of prominences in each ten degrees of solar latitude, together with their heights and sizes.

July.—A note on the presentation of a medal to Prof. H. Draper by the United States Government for his assistance in preparing for the Transit of Venus.—Observations of the positions in which prominences containing magnesium occurred during July 1873, by Prof. Tacchini.—Drawings of chromosphere during March and April 1874, by Secchi and Tacchini.

August.—A continuation of table by Tacchini, showing positions on sun where prominences containing magnesium occurred during August and September 1873.—Prof. Tacchini writes on observation of the Perseids of last August, in which he gives the mean radiant point as 2h. 50m. and + 53° 8′·6.

Verhandlungen der k. k. geologischen Reichsanstalt. Vienna, Sept. 30.—In this number Dr. Schimper describes the geological conditions of the district of Arrho, in Abyssinia, and a curious apparently volcanic phenomenon met with there. The district is a cleft-crossed plain near (and below the level of) the

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Red Sea, from which it is separated by a low range of hills. The gentle rains at one part of the year supply sufficient moisture to heat the iron pyrites scattered over the surface of Arrho to a mild glow; the substance is decomposed, lixiviated, and brought into combination with several combustible matters, and eruptions like those of volcanoes take place; slime cones are formed from four to twelve feet in height, from which, as from pipes, issue steam and flame. These generally ephemeral formations consist of mud which is mixed with sulphur and salt, and in the dried cones may be found almost pure sublimated sulphur. The general appearance of the place is like that of pulp boiling in a huge, angular, zig-zag cauldron. The phenomenon continues till increased rains lay the ground under water, after disappearance of which at the end of the rain periods, a hard salt crust, several inches thick, covers the ground.—The trachytes of the island of Cos are described by Dr. Dölter; Dr. Stache gives an account of the eruptive rocks in the Ortler region and the mountain group of the Zwölfer-Spitz in Upper Vintschgau; and Dr. Hörnes, of observations in the district where the Rienz takes its rise.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Nov. 25.—On the production of Glycosuria by the effect of oxygenated blood on the liver, by F. W. Pavy, M.D., F.R.S.

The conclusions arrived at are that the amyloid substance found in the liver is a body which tends to accumulate in certain animal structures under the existence of a limited supply of oxygen, and that it is through the liver exceptionally receiving the supply of venous blood it does, that the special condition belonging to it is attributable. It is also shown that the undue transmission of oxygenated blood to that organ at once induces an altered state, which is rendered evident by the production of glycosuria.

On the Structure and Relations of the Alcyonarian *Heliopora cœrulea*, with some account of the anatomy of a species of *Sarcophyton*; notes on the structure of species of the genera *Millepora*, *Pocillopora*, and *Stylaster*, and remarks on the affinities of certain Palæozoic Corals, by H. M. Mozeley, Naturalist on the *Challenger* Expedition.

The title of this paper indicates the nature of its contents. The author has not been able to decide whether *Millepora* is one of the actinozoa or belongs to the hydrozoa as stated by Prof. Agassiz. *Heliopora* is undoubtedly alcyonarian.

Mathematical Society, Dec. 9.—Prof. H. J. S. Smith, F.R.S., president, in the chair.—Major J. R. Campbell and Prof. G. M. Minchin were elected members.—Prof. Clifford read a paper on the transformation of elliptic functions, in which he attempted to apply Jacobi's geometrical representation of the addition-theorem in elliptic functions to the theory of their transformation.—Prof. Cayley spoke on a system of algebraical equations connected with Malfatti's problem. The communication was an extension of a paper by the same gentleman in the *Cambridge and Dublin Mathematical Journal*, tom. iv., 1849, pp. 270–275.—The chairman next communicated three short notes: 1. On a problem of Eisenstein's. If p is an uneven prime, the function $4\,\frac{x^p-1}{x-1}=Z$ can always be expressed in the form $Y^2-(-1)^{\frac{1}{2}(p-1)}p\,X^2$, where X and Y are rational and integral functions of x, having integral coefficients. This is a theorem of Gauss. Eisenstein's problem (*Crelle's Journal*, vol. xxvii. p. 83) is "to determine the cases in which the equation $Z=Y^2-(-1)^{\frac{1}{2}(p-1)}p\,X^2$ admits of a multiplicity of solutions, and to ascertain the law connecting the various solutions, when there is more than one." The solution of this problem is as follows:—If $[T,\ U]$ is *any* solution whatever in integral numbers of the equation $T^2-(-1)^{\frac{1}{2}(p-1)}p\,U^2=4$, and $[X,\ Y]$ is any one given solution of Gauss's equation, then all the solutions of Gauss's equation are comprised in the formula—

$$\left[\tfrac{1}{2}\left(TX+(-1)^{\frac{p-1}{2}}p\,UV\right),\ \tfrac{1}{2}(UX+TY)\right].$$

Thus if $p=4n+3$ the equation admits of but one solution (the four solutions $[\pm X,\ \pm Y]$ being regarded as but one) except in the case $p=3$, when it admits of three; if $p=4n+1$, the equation admits of an infinite number of solutions. That the functions $[\tfrac{1}{2}(TX+p\,UY),\ \tfrac{1}{2}(UX+TY)]$ are all of them solutions of Gauss's equation is evident; the proof that this formula comprises all the solutions of the equations is less elementary, because it depends on the irreducibility of the function Z. There exists a general theory of the representation of rational and integral functions of x by quadratic forms; such representation being, of course, only possible when the given function of x is capable of resolution into two factors by the adjunction of a quadratic surd.—2. On the joint invariants of two conics, or two quadrics. Let P and Q be two conics, and let 1 2 3 be any triangle self-conjugate with regard to P. Let also P_1, P_2, P_3, be the rectangles of the points 1, 2, 3, with regard to the conic P, these rectangles being taken upon transversals measured in any fixed direction; and let Q_1, Q_2, Q_3, have similar meanings with regard to the conic Q, the direction of the transversals being also fixed. Then the expression $\frac{Q_1}{P_1}+\frac{Q_2}{P_2}+\frac{Q_3}{P_3}$ has the same value for all self-conjugate triangles of P; and is, in fact, that invariant of P, Q, which is linear with regard to Q, and quadratic with regard to P, and the evanescence of which expresses that Q harmonically circumscribes P. The corresponding theorem in the geometry of the straight line is: "If Q_1, Q_2, P_1, P_2, are two pairs of fixed points on a line, and if A_1, A_2, is any pair of harmonic conjugates of $P_1\,P_2$, the value of the expression

$$\frac{A_1Q_1\cdot A_1Q_2}{A_1P_1\cdot A_1P_2}+\frac{A_2Q_1\cdot A_2Q_2}{A_2P_1\cdot A_2P_2}$$

is independent of the particular pair $A_1\,A_2$ considered." From this theorem, the result given above for two conics follows immediately; from it the corresponding property for two quadrics may be inferred, viz.:

$$\frac{Q_1}{P_1}+\frac{Q_2}{P_2}+\frac{Q_3}{P_3}+\frac{Q_4}{P_4}=\text{constant};$$

and so on for quadratic functions containing any number of indeterminates. 3. On the equation $P\times D=$ constant, of the geodesic lines of an ellipsoid. From this equation (in which P is the perpendicular from the centre upon the tangent plane at any point of the geodesic, and D is the semi-diameter parallel to the tangent line of the geodesic) it is convenient to be able to infer directly the principal properties of the geodesic line, without having first to transform the equation into M. Liouville's form, $\mu^2\cos^2 i+\nu^2\sin^2 i=a^2$. In Dr. Salmon's "Geometry of Three Dimensions," the theorem of the constancy of the sum or difference of the geodesic radii vectores, drawn from any point of a line of curvature to two umbilics, is thus demonstrated. And it is worth while to add (though it is very improbable that the point has not been noticed before) that a proof of the theorem that two geodesic tangents of a line of curvature which intersect at right angles, intersect on a sphero-conic, may similarly be obtained without transforming the equation. Let Q be the point where the two geodesic tangents intersect at right angles, O the centre of the ellipsoid; let $c=OQ$, and let a, b be the semi-axes of the central section parallel to the tangent plane at Q. The two geodesics make angles of 45° with the lines of curvature at Q: hence, for either of these geodesic lines, $D^2=\frac{2a^2b^2}{a^2+b^2}$. Let Q' be a second point where two geodesic tangents to the same line of curvature intersect at right angles; then $\frac{2P^2a^2b^2}{a^2+b^2}=\frac{2P'^2a'^2b'^2}{a'^2+b'^2}$, because $P\times D$ has the same value for all geodesic lines touching the same line of curvature. But $P^2a^2b^2=P'^2a'^2b'^2$, because parallelepipeds circumscribing an ellipsoid with their faces parallel to conjugate diametral planes are equal. Hence $a^2+b^2=a'^2+b'^2$. But also $a^2+b^2+c^2=a'^2+b'^2+c'^2\therefore c=c'$, and Q and Q' lie in the same sphero-conic. Mr. Tucker (in the absence of the author) brought before the Society a paper by Mr. H. W. Lloyd Tanner on the solution of certain partial differential equations of the second order, having more than two independent variables. The equations considered are included in the form—

$$\sum_{i=1}^{i=n}\ \sum_{j=1}^{j=n} V_{ij}\,\frac{d^2z}{dx_i\,dx_j}+V_0=0\quad .\quad .\quad .\quad (1)$$

where $V_{ij}\,V_0$ are functions of

$$x_1\ .\ .\ .\ x_n,\ z,\ p_1\left(\equiv\frac{dz}{dx_1}\right)\ .\ .\ .\ p_n\left(\equiv\frac{dz}{dx_n}\right),$$

and it is proposed to investigate the conditions that (1) should be soluble in terms of arbitrary functions, the arguments of

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